PCT/GB04/001802

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed R. Mahoney

Dated 25 May 2004

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

THE PATENT OFFICE
JL
10 OCT 2003
RECEIVED BY FAX

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1.	Your reference	10 OCT 2003 P3205GB/B436GB2	
2.	Patent application number *(The Patent Office will fill in this)*	0323707.0	10OCT03 E843527-1 002902 P01/7700 0.00-0323707.0
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	TYCO ELECTRONICS RAYCHEM N V Diestsesteenweg 692 B-3010 Kessel-10 Belgium	
	Patents ADP number *(if you know it)*		8302190001
	If the applicant is a corporate body, give the country/state of its incorporation		
4.	Title of the invention	AN IMPROVED CONNECTOR DEVICE FOR COUPLING OPTICAL FIBRES, AND METHOD OF PRODUCTION THEREOF	
5.	Name of your agent *(if you have one)*	BRYER Kenneth Robert K R Bryer & Co 7 Gay Street Bath BA1 2PH	
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*		10777002
	Patents ADP number *(if you know it)*		

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application		Date of filing *(day / month / year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	Yes		

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	5
Claim(s)	2
Abstract	
Drawing(s)	1

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translation of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature

Date
10 October 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

BRYER Kenneth Robert
01225 428877

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

AN IMPROVED CONNECTOR DEVICE FOR COUPLING OPTICAL FIBRES, AND METHOD OF PRODUCTION THEREOF

The present invention relates generally to an improved connector device for coupling optical fibres, and to a method of production thereof.

The present invention is a development of our British patent application number 0309908.2 which describes a connector device for coupling non-aligned optical fibres, in which light is directed from one fibre to another by a reflector and the positional relationship between the ends of the optical fibres of the reflector is determined by means for locating the end of each optical fibre to be coupled in a predetermined position both parallel to and transverse the length of a fibre.

It has become apparent, however, that the same coupling principles can be applied to a coupling not just between two fibres, but also between one fibre and another optical component such as a light source or photo detector.

Accordingly, the present invention provides a connector device for optically coupling an optical fibre to another optical component whereby to deliver light to or receive light from it, in which the positional relationship between the end of the optical fibre and the said other optical component is determined by means for locating the end of the said optical fibre in a predetermined position both parallel to and transverse the length of the fibre with respect to the said optical component.

In a preferred embodiment there is provided a lens in the path of light between the end of the said optical fibre and the said other component.

The need for a lens will, in general, be dependent on the form of the said other optical component, and in particular whether the light-sensitive surface thereof or the light generated thereby can be directed to enter the optical fibre in a conversing beam without the need for a lens. In the majority of cases a lens is expected to be preferable in order to obtain the most effective degree of conversance.

In embodiments having such a lens, the lens is preferably one formed by irradiation of selected regions of a body of polymer material followed by a treatment including selective exposure to a monomer at or above a critical temperature at which the monomer diffuses into the radiated regions of the polymer.

The means for locating the ends of the fibres may be formed by irradiation of a selected region of a body of polymer material, followed by a treatment including selective exposure to a monomer at or above a particular temperature at which the monomer diffuses into the radiated regions of polymer, and thereafter a selective etching of the thus-treated region to result in an accurately-formed opening for receiving the end of the fibre whereby to locate it in the said predetermined position.

The present invention also comprehends a method of producing a connector device as defined hereinabove by the steps of irradiating at least one selected region of a body of polymer material,

treating the irradiated region by selective exposure to a monomer at or above a critical temperature at which the monomer diffuses into the irradiated region of the polymer,

selective etching of the thus-treated region of the polymer to result in an accurately-formed opening for receiving the end of the optical fibre to be connected, and

optionally treating another part of the body of polymer to form a lens surface.

In the preferred method the lens surface is formed by intumescence resulting from contact with the irradiated region of the polymer by a monomer vapour.

Once the master connector device has been formed. Production of the component may be achieved using mass production techniques such as micro-replication, ejection moulding or hot embossing.

Various embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a sectional view through a first embodiment of the invention; and

Figure 2 is a sectional view through an alternative embodiment of the invention.

Referring now to the drawings there is shown an optical fibre generally indicated 101 which is intended to be optically coupled to a photo detector generally indicated 102

having a photosensitive surface 103. The photo detector is connected to an amplifier 104 the output of which is supplied via a line 105 to electrical components for managing, or manipulating the electrical signal as appropriate.

The optical connector device of the invention comprises a monolithic body 106 of polymeric material having a front face 107 and a rear face 108. These faces may be substantially parallel to one another or may diverge at an angle in dependence on the nature of the optical coupling it is intended to perform.

In the front face 107 is formed a recess or cavity 109 which is accurately formed to the dimensions of the optical fibre 101 such that this can be optically coupled to the connector 106 simply by introduction into the cavity 109. Suitable means (not shown) may be provided for retaining the optical fibre in position in the cavity. Such devices are described in outline form in our earlier British Patent application number 0309908.2 the contents of which are incorporated herein by reference.

On the rear face 108 of the body 106 is a substantially spherical curved surface 110 the curved surface 110 is shaped and dimensioned in relation to the cavity 109 such that a beam of light (the outer rays of which are illustrated by the two broken lines 111, 112) which represents the exit or entering cone of light from an optical fibre 101 located in the cavity 109, is refracted at the interface 110 to a focal area on the sensitive surface 103 of the photodetector.

A similar configuration, not illustrated in detail, may be employed for a source of light

where, again, the relationship between the end of the optical fibre and the source of light needs to be established accurately. In the embodiment of Figure 1, although not shown in detail, there is naturally present a physical interconnection between the body 106 and the photodetector 102 which enables a precise relationship to be established between the position and orientation of the cavity 109, and therefore the end of the optical fibre 101 and the photo-sensitive surface 103 by means of an adjustable connection or a fixed, predetermined connection as suits the case. It will be seen that such a connector provides for "in-line" connection of the optical fibre 101 to a photo sensor. There may be circumstances where the photo-sensitive surface of a photodetector cannot conveniently be located in line with the direction of the optical fibre, in which case the embodiment of Figure 2 may be employed. In this embodiment the same or corresponding components have again been allocated the same reference numerals. Here, however, the photo sensitive surface 103 lies parallel to the length of the optical fibre 101 rather than orthogonal to it as in the embodiment in Figure 1, and light is reflected by a reflector 113 positioned between the reflective surface 110 and the photo detector 102. In this embodiment, unlike that of Figure 1, the light from the refractor surface 110 is collimated, that is forms a parallel beam directed at the reflector 113, rather than being focused at a particular area of the photo sensitive surface 103 as in the embodiment of Figure 1.

CLAIMS

1. A connector device for optically coupling an optical fibre to another optical component whereby to deliver light to or receive light from it, in which the positional relationship between the end of the optical fibre and the said other optical component is determined by means for locating the end of the said optical fibre in a predetermined position both parallel to and transverse the length of the fibre with respect to the said optical component.

2. A connection device as claimed in Claim 1, in which there is provided a lens in the path of light between the end of the said optical fibre and the other optical component.

3. A connector device as claimed in Claim 2, in which the said lens is one formed by irradiation of selected regions of a body of polymer material followed by a treatment including selective exposure to a monomer at or above a critical temperature at which the monomer diffuses into the irradiated regions of the polymer.

4. A connector device as claimed in any of Claims 1 to 3, in which the means for locating the end of the fibre is formed by irradiation of a selected region of a body of polymer material, followed by a treatment including selective exposure to a monomer at or above a critical temperature at which the monomer diffuses into the irradiation regions of the polymer, and thereafter a selective etching of the thus-treated region to result in an accurately formed opening for receiving the end of the optical fibre

whereby to locate it in the said predetermined position.

5. A connector device according to any preceding claim, in which the said other optical component is a light source.

6. A connector device as claimed in any of Claims 1 to 4, in which the said other optical component is a photo detector.

7. A method of producing a connector device as claimed in any of Claims 1 to 6, by the steps of irradiating at least one selected region of a body of polymer material,

treating the irradiated region by selective exposure to a monomer at or above a critical temperature at which the monomer diffuses into the irradiated region of the polymer,

selective etching of the thus-treated region of the polymer to result in an accurately-formed opening for receiving the end of the optical fibre to be connected, and

optionally treating another part of the body of polymer to form a lens surface.

8. A method as claimed in Claim 7, in which a lens surface is formed by intumescence resulting from contact with the irradiated region of the polymer by a monomer vapour.

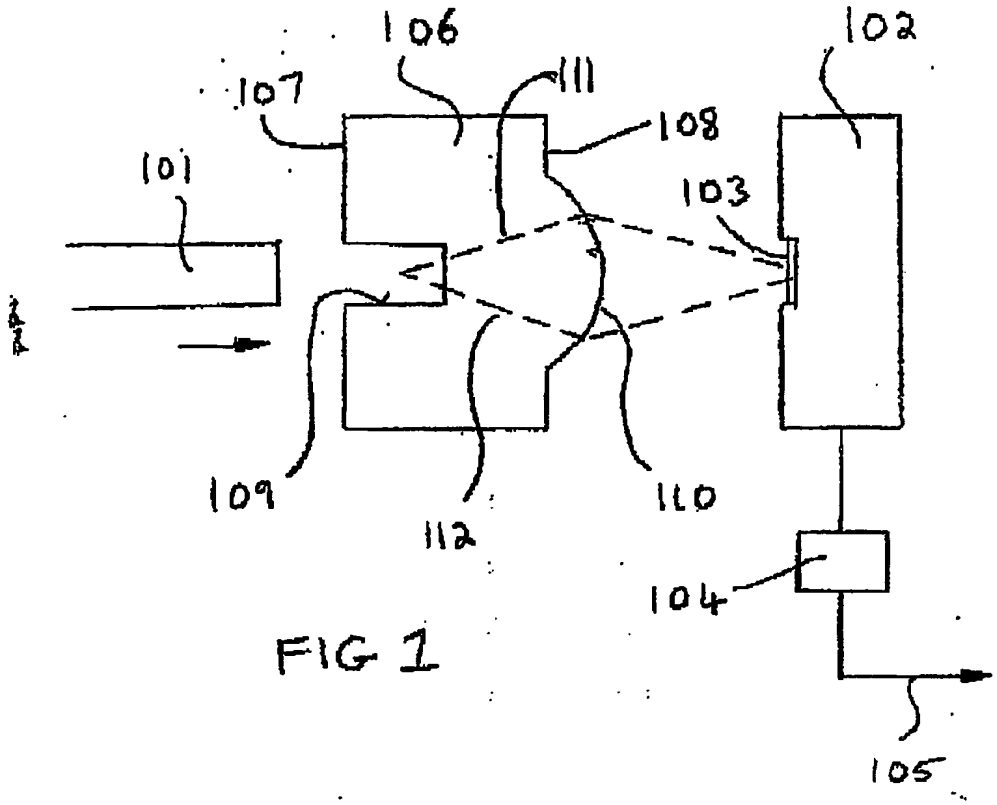

FIG 1

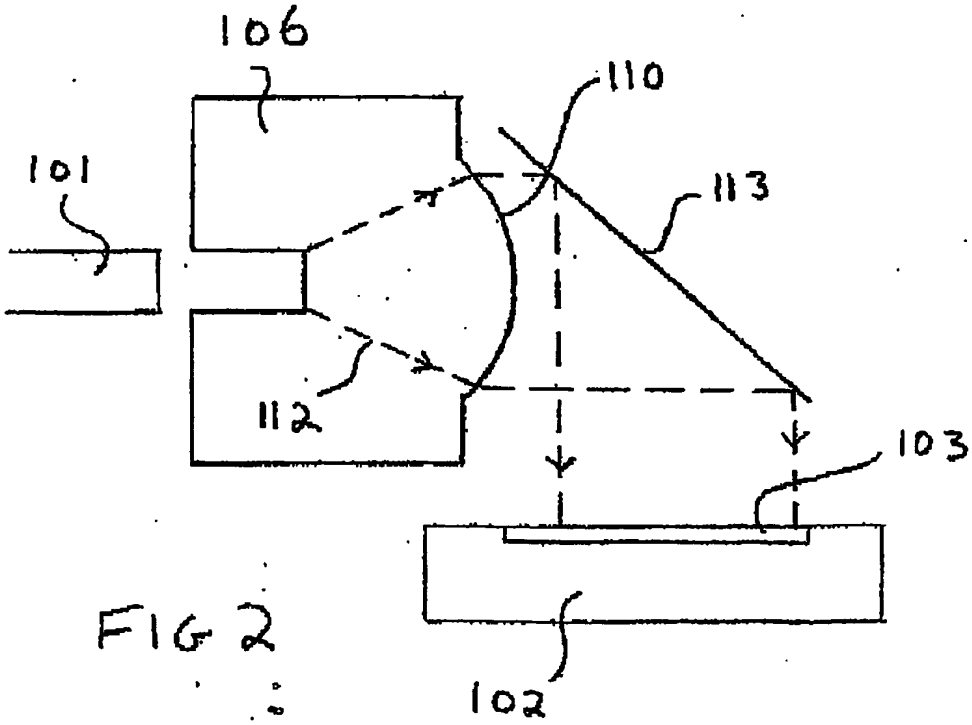

FIG 2